PHYSIOLOGY.[1]

Effects of stimulating nerve cells.—A full account of Hodge's work on this subject has recently appeared.[2] The results are highly interesting and important. The author's method was to stimulate for several hours (with regular periods of rest) the nerves attached to several of the spinal ganglia of the frog or the cat. The stimulated ganglion and a resting ganglion of the same animal were then excised and subjected to *identical treatment* in preparation for histological examination and comparison. Corrosive sublimate was the usual hardening reagent, and some or all of the components of Gaule's quadruple stain were used for staining. The chief results of the stimulation are:—

A. For the nucleus: 1. Marked decrease in size. 2. Change from a smooth and rounded to a jagged, irregular outline. 3. Loss of open reticular appearance with darker stain.

B. For the cell protoplasm: 1. Slight shrinkage in size. 2. Lessened power to stain or to reduce osmic acid. 3. Vacuolation.

C. For the cell capsule: Decrease in size of the nuclei.

The effects of the work are exhibited chiefly by the large cells, the small cells showing little or no change. Incidental observations on the connection of the cells and the fibres in the ganglia were made. Careful teasing of ganglia by means of a fine jet of water instead of needles showed that no apolar cells were present; typical bipolar cells and T-cells occur; other suggestive details were made out which are at present being investigated. Careful counting of the fibres of a posterior root and of the cells (*i.e.*, the nucleoli) in the corresponding ganglion showed the cells to be much more numerous—in the most careful count 1340 fibres and 4456 cells. This indicates a complex relation of the two within the ganglion.

Spinal ganglia.—The vexed question of the relation of the nerve fibres to the nerve cells in the spinal ganglia has been subjected to a new investigation by Gad and Joseph.[3] They employed the *ganglion jugulare* of the rabbit, which is attached to the vagus nerve outside the

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[2] *American Journal of Psychology*, May, 1889. For preliminary account see the same journal, May, 1888. Cf. also AMERICAN NATURALIST, April, 1889, p. 274.

[3] Du Bois Reymond's *Archiv*, 1889, p. 199.

skull. The central branch of this ganglion is of sufficient length to allow stimulation; the peripheral branch, the vagus nerve, has the great advantage that its functions are well known. The effects which cutting of the central and the peripheral branches and the consequent degeneration have upon both the structure and function of the nerve fibres of the vagus were studied, together with the time occupied by the passage of the nerve current through the ganglion. The authors feel justified in drawing the following conclusions from their work:— Most centripetal nerve paths are interrupted in the spinal ganglia by bipolar nerve cells. The function of these nerve cells is to exercise a trophic influence over the nerve fibres joining them. For the maintenance of the normal structure and function of centripetal nerve fibres connection with the spinal ganglia is necessary and sufficient. Every excitation wave of a centripetal nerve fibre must pass through a nerve cell in the spinal ganglion. Whether the difference of time in the reaction from stimulating peripherally and centrally from the ganglion is due to retardation of the nerve current in its passage through the ganglion, or to a special summation of subminimal stimuli there taking place, is uncertain. (The former time was .036 sec. longer than the latter, the centripetal fibres being stimulated and the reaction being the effect on the respiration movements.) The loss of function of both centripetal and centrifugal nerve fibres that have been separated from their trophic centres is fully developed in animals at the end of the second or the beginning of the third day. The vascularization of the spinal ganglia is sufficiently provided for by the vessels accompanying the nerve stems and nerve roots.

Voluntary impulses and inhibitions.—The nerve process originating in the gray matter of the central nervous system stands in a two-fold relation to muscular activity,—it either calls forth that activity or it puts a stop to it, it is either impulsive, motor, or it is inhibitory. What relation do these two varieties of the process bear to each other? Are they similar in nature? Are they similarly localized? Is their difference due to different directions of their wave motion? These questions and others have remained unanswered. Orschansky[4] thinks to throw light upon them by studying the time reactions of the two processes under various conditions. The masseter muscle was used, its great advantage being that, when the teeth are closed, the muscle can be made to contract and relax without the intervention of antagonistic muscles. Munk's idea that the impulse to relaxation of a muscle, *i.e.*, inhibition,

[4] *Archiv für Anat. und Phys.*, Physiol. Abtheil., 1889, p. 173.

is identical with the impulse to activity of its antagonist, was thus excluded. The subject of the experiment contracted or relaxed his masseter muscle upon feeling an electric stimulus upon the wrist, the movements with time curve being recorded upon a revolving drum. The results show practical equality in the two forms of will activity (*e.g.*, the contraction reaction time=.15 sec., the relaxation reaction time=.14 sec.), the slight differences being attributable to the method of experimentation. Exercise shortens both; increase of intensity of stimulus shortens both alike; both are similarly affected by alteration in the intensity and amplitude of the muscle contraction; alcohol at first shortens, then lengthens both; in short, the experiments argue against the dualistic theory of the two processes. If then voluntary impulses and inhibitions are physiologically identical, the anatomical localization of the interference of the two processes must be in the psychomotor centre. The effects of attention were studied, but have not yet been completely formulated.

PSYCHOLOGY.

History of the Owl, continued.—To the readers of the AMERICAN NATURALIST it may not be amiss to know something more of the final history of the two owls, the great horned and the barred, whose habits were described in the January number.

The lively disposition of the "bubo" increased as he grew older, and at times he would jump and fly about his room with a waggish air that was very amusing.

The Syrnium, on the contrary, became more sullen and morose, and seemed to be constantly in the "sulks" about something.

Their combined hootings at early dawn and twilight were music indeed to the ear of a naturalist. Cloudy days or an approaching storm would also excite the barred owl into uttering his peculiar notes; his mate not infrequently joining in the chorus.

One day in March, while driving on the prairie, I shot and winged a fine specimen of the American rough-legged hawk (*Archibuteo lagopus sanctijohannis*). Not having time that day to make a specimen of him, I put him for safe keeping in with the owls. The next morning, upon presenting myself at the door, I was greeted by a regular pandemonium of hoots and screeches, which at once struck me as presaging no good to my hawk, and, in fact, the latter was nowhere to be seen.